IN THE CLAIMS

Please amend the claims as indicated:

1 1. (currently amended0 A computer implemented method of modeling which models 2 failure of a borehole in a subsurface formation, the method comprising: 3 (a) defining a subsurface model in the computer, the model including a plurality of regions, said plurality of regions including the borehole and at 5 least one additional region selected from (i) a liner in the borehole, (ii) a 6 casing in the borehole, and (iii) at least one earth formation, each of said 7 plurality of regions comprising a plurality of nodes interconnected by a 8 plurality of linkages, 9 (b) defining material properties associated with said nodes and said linkages 10 of said subsurface model, said material properties having a statistical 11 variation; 12 (c) specifying an initial deformation pattern of the model; and 13 using a dynamic range relaxation algorithm (DRRA) implemented on the (d) 14 computer to find a force equilibrium solution for said subsurface model 15 and said initial deformation pattern giving a resulting deformed model 16 including fracturing. 17 1 2. (original) The method of claim 1, wherein said nodes are arranged in a grid that is 2 one of (i) a triangular grid, and, (ii) a random grid. 3

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1	3.	(original) The method of claim 1 wherein said linkages are selected from the
2		group consisting of (A) springs, (B) beams, and. (C) rods.
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4. (original) The method of claim 1 wherein said linkages comprise springs, the method further comprising defining a normal force associated with each spring.

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5. (original) The method of claim 1 wherein said linkages comprise beams, the method further comprising defining at least one of (A) a normal force, and (B) a shear force associated with each beam.

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1 6. (original) The method of claim 1 wherein said linkages comprise rods, the method 2 further comprising defining at least one of (A) a normal force and (B) a force 3 associated with an angle between pairs of said adjacent ones of the plurality of rods.

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7. (original) The method of claim 1, wherein using the dynamic range relaxation algorithm further comprises applying said initial deformation model in a plurality of steps, each step comprising applying a specified fraction of the initial deformation and determining if any linkages between the nodes have been deformed beyond a breaking point and identifying a subset of the linkages that have been so deformed.

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•	Q.	(original) The include of claim 7, wherein applying the dynamic range relaxation
2		algorithm further comprises iteratively breaking the one linkage of the subset of
3		linkages that has been deformed the most and applying a relaxation algorithm to
4		the remaining unbroken linkages.
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1	9.	(original) The method of claim 9 wherein the at least one earth formation further
2		comprise a near earth formation including a gravel pack and a far earth formation.
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1	10.	(original) The method of claim 1 wherein the plurality of regions comprises a
2		liner in the borehole, an earth formation including a near earth formation and a far
3		earth formation, and a gravel pack disposed between the liner and the near earth
4		formation.
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1	11.	(original) The method of claim 1 wherein said linkages connect at least one
2		selected node of said plurality of nodes with (i) a plurality of nearest neighbors of
3		the at least one selected node, and (ii) a plurality of next nearest neighbors of the
4		at least one selected node.
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1	12.	(original) The method of claim 1 wherein said earth formations include a fluid,
2		said fluid flowing into the borehole, and said deformation pattern is determined in
3		part by a decrease in formation fluid pressure resulting from flow of said fluid
4		into the borehole.

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1 13. (original) The method of claim 12 wherein using the DRRA further comprises

2 determining an additional force at each node related to a difference in said fluid

pressure on opposite sides of at least a subset of the plurality of nodes. 3

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1 14. (original) The method of claim 13 wherein determining said additional force

further comprises performing a simulation selected from (i) a finite difference

3 simulation, and, (ii) a finite element simulation, of said fluid flow.

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(original) The method of claim 14 wherein performing said simulation further 1 15.

comprises changing at least one of (A) a permeability, and, (B) a porosity used in

said simulation responsive to said deformation.

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16. (original) The method of claim 1 wherein said borehole includes a substantially

2 vertical section wherein said initial deformation pattern is substantially

azimuthally symmetric about an axis of the borehole in said section.

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1 17. (original) The method of claim 16 wherein said borehole includes a deviated

2 section wherein said initial deformation pattern is asymmetrical about an axis of

3 the borehole.

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18. (currently amended) A computer implemented method of modeling which models

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L		Tankar	c of a potential in a substitute formation, the method comprising:
3		(a)	defining a subsurface model in the computer, the model having a plurality
4			of nodes and including a plurality of regions, said plurality of regions
5			including the borehole and at least one additional region selected from (i)
6			a liner in the borehole, (ii) a casing in the borehole, and (iii) at least one
7			earth formation, each of said plurality of regions comprising a plurality of
8			nodes interconnected by a plurality of linkages,
9		(b)	defining material properties associated with said nodes and said linkages
10			of said subsurface model, said material properties having a statistical
11			variation;
12		(c)	specifying a force distribution applied to the model at boundary nodes of
13			said plurality of nodes; and
14		(d)	using a dynamic range relaxation algorithm (DRRA) implemented on the
15			computer to find a force equilibrium solution for said subsurface model
16			and said force distribution giving a resulting deformed model including
17			fracturing.
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1	19.	(origi	nal) The method of claim 18 wherein the subsurface formation has been
2		subje	cted to large scale geologic deformation and wherein specifying said force
3		distri	bution further comprises:
4		(i)	simulating the large scale geologic deformation to determine a stress
5			distribution in the subsurface formation in the absence of the borehole,
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6	(ii)	defining a	trajectory	for the	borehole	therein, and	d
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7 (iii) identifying locations along said trajectory that are likely to fail.

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1 20. (original) The method of claim 18 wherein the forces can vary between the

2 boundary nodes.

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1 21. (original) The method of claim 19 wherein identifying said trajectories further

2 comprises removing a plurality of nodes along said trajectory.

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1 22. (original) The method of claim 18, wherein said nodes are arranged in a grid that

2 is one of (i) a triangular grid, and, (ii) a random grid.

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1 23. (original) The method of claim 18 wherein said linkages are selected from the

2 group consisting of (A) springs, (B) beams, and. (C) rods.

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1 24. (original) The method of claim 18 wherein said linkages comprise springs, the

method further comprising defining a normal force associated with each spring.

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1 25. (original) The method of claim 18 wherein said linkages comprise beams, the

method further comprising defining at least one of (A) a normal force, and (B) a

3 shear force associated with each beam.

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26.	(origin	nal) The method of claim 18 wherein said linkages comprise rods, the
	metho	od further comprising defining at least one of (A) a normal force and (B) a
	force :	associated with an angle between pairs of said adjacent ones of the plurality
	of rod	S.
27.	(origin	nal) The method of claim 18, wherein using the dynamic range relaxation
	algori	thm further comprises applying said force distribution in a plurality of steps,
	each s	tep comprising applying a specified fraction of the initial force and
	detern	nining if any linkages between the nodes have been deformed beyond a
	breaki	ing point and identifying a subset of the linkages that have been so
	deform	med.
28.	(origi	nal) The method of claim 27, wherein applying the dynamic range
	relaxa	tion algorithm further comprises iteratively breaking the one linkage of the
	subset	t of linkages that has been deformed the most and applying a relaxation
	algori	thm to the remaining unbroken linkages.
29.	(curre	ntly amended) A computer implemented method of modeling which models
	faultir	ng and fracturing in a subsurface volume of the earth comprising:
	(a)	defining said subsurface model in the computer, the model including a
		plurality of interconnected nodes and material rock properties within the
		subsurface volume;
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	27. 28.	force of rod 27. (original algorial each seach

6		(b)	specifying a stress distribution at a subset of said plurality of nodes, said
7			subset comprising boundary nodes; and
8		(c)	using a dynamic range relaxation algorithm implemented on the computer
9			to find a force equilibrium solution for said subsurface model and said
10			stress distribution giving a resulting deformed model including fracturing.
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1	30.	(origin	nal) The method of claim 29, wherein defining a subsurface model, and
2		specif	ying said stress distribution further comprises using a graphical user
3		interfa	ice.
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1	31.	(origin	nal) The method of claim 29, wherein said nodes are arranged in a grid that
2		is one	of (i) a triangular grid, and, (ii) a random grid.
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1	32.	(origin	nal) The method of claim 29, wherein said nodes are interconnected by
2		linkag	es selected from (i) springs, (ii) beams, and, (iii) rods.

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